

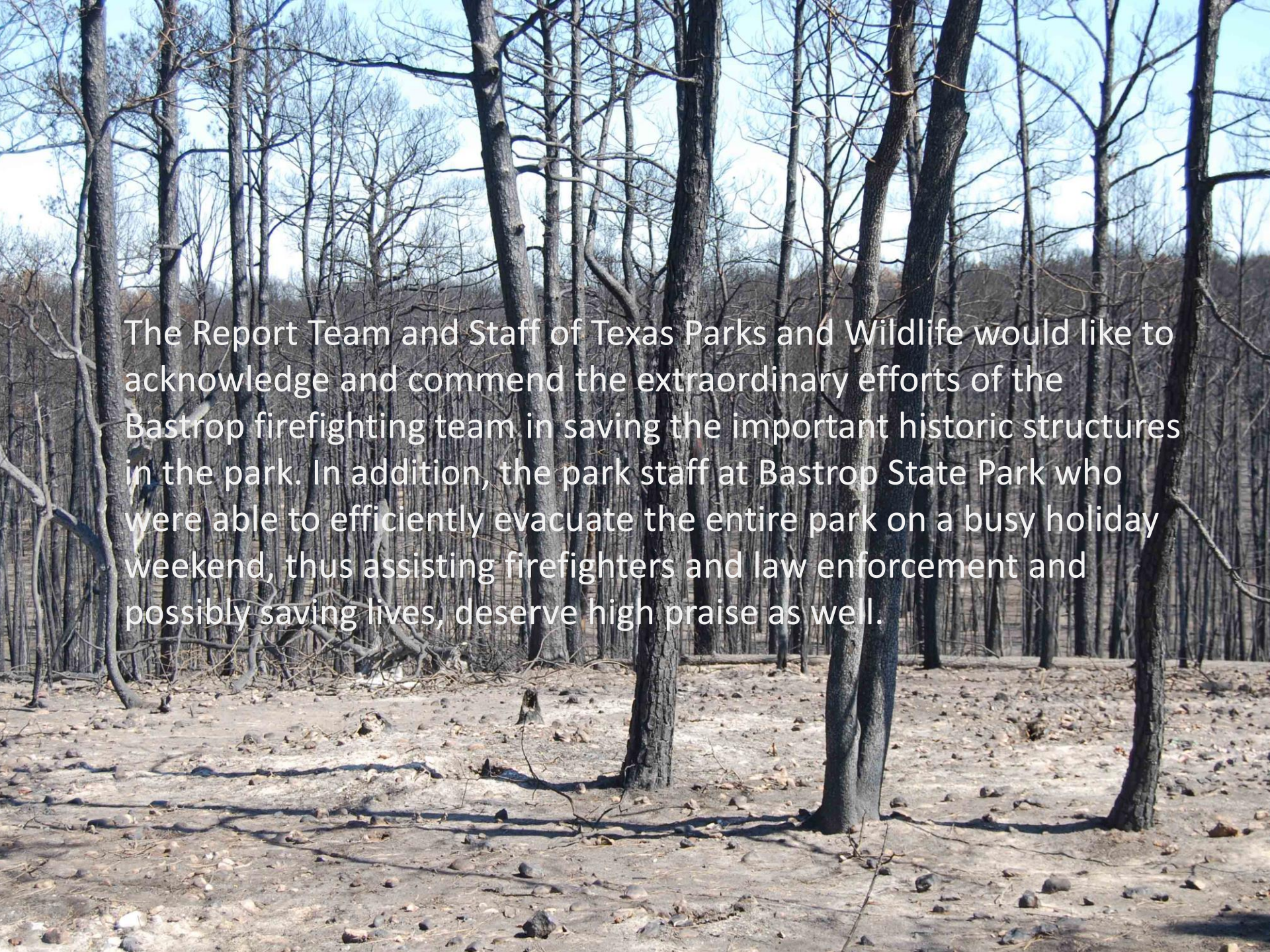
A photograph of a stone tower at Bastrop State Park at night. The tower is made of rough-hewn stones and has several small, dark openings. In the background, a large wildfire is visible, with bright orange and red flames and smoke rising into the dark sky. The scene is illuminated by the fire and some ambient light.

# Learning from Texas Wildfires: Bastrop State Park and Beyond



Funded by a grant for the  
National Park Service's Center  
for Preservation Technology  
and Training





The Report Team and Staff of Texas Parks and Wildlife would like to acknowledge and commend the extraordinary efforts of the Bastrop firefighting team in saving the important historic structures in the park. In addition, the park staff at Bastrop State Park who were able to efficiently evacuate the entire park on a busy holiday weekend, thus assisting firefighters and law enforcement and possibly saving lives, deserve high praise as well.

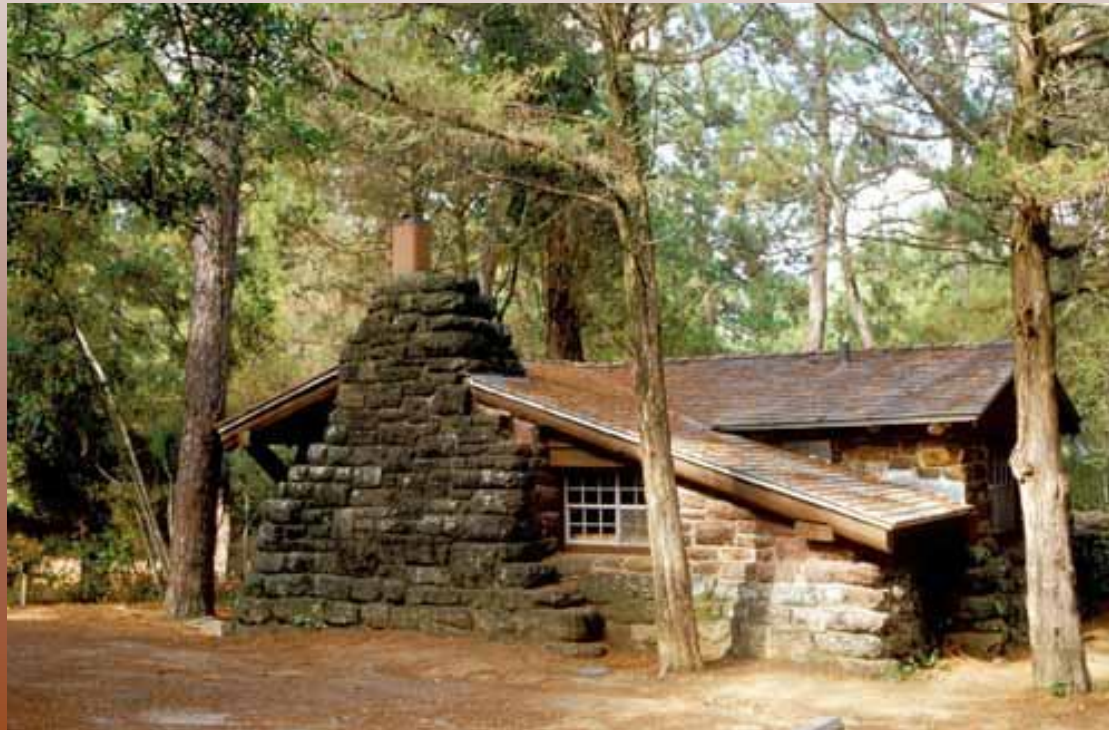


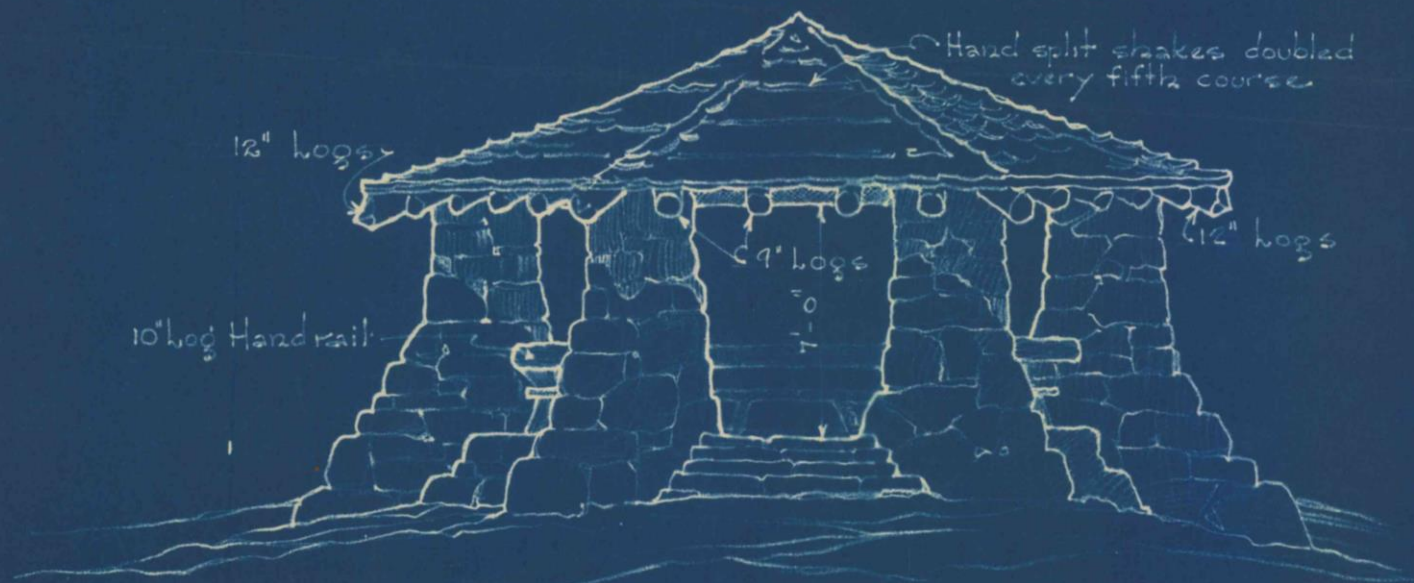
# Grant

- NPS (through NCPTT) awarded the grant to study the effects of the fire in May 2012.
- Team consisted of TPWD staff, and the “UT Team” from the School of Architecture’s Historic Preservation Program: Professor Fran Gale, Graduate Student Miriam Tworak-Hoffstetter, and Alum Casey Gallagher.
- Goal was to study the effects of the fire, as well as the effective techniques used to save structures, in hopes to provide tools for future planning for wildfires in State Parks.

# Bastrop State Park

- CCC era buildings built between 1933-37
- Built from locally quarried stone and nestled in the dense piney forest.





ELEVATION  
Scale  $\frac{1}{4}'' = 1'-0''$

## SUGGESTED REVISION OF LOOKOUT HOUSE No. 2

TEXAS STATE PARK SP. 22T  
BASTROP TEXAS

DEPARTMENT OF THE INTERIOR  
NATIONAL PARK SERVICE, ECW  
THIRD DISTRICT OFFICE, OKLA. CITY  
DRAWN BY *Milton Smith*

# The Fire

- Labor Day weekend 2011
- Historic drought had created dangerous conditions
- Ignited and spread quickly (5mph) through dry forest
- Fire moved both on the ground and through tree crowns
- Firefighting effort between park firefighters and several local fire units





[deannaroy.com](http://deannaroy.com)





- <http://www.youtube.com/watch?v=vhJeDYQVtdQ>

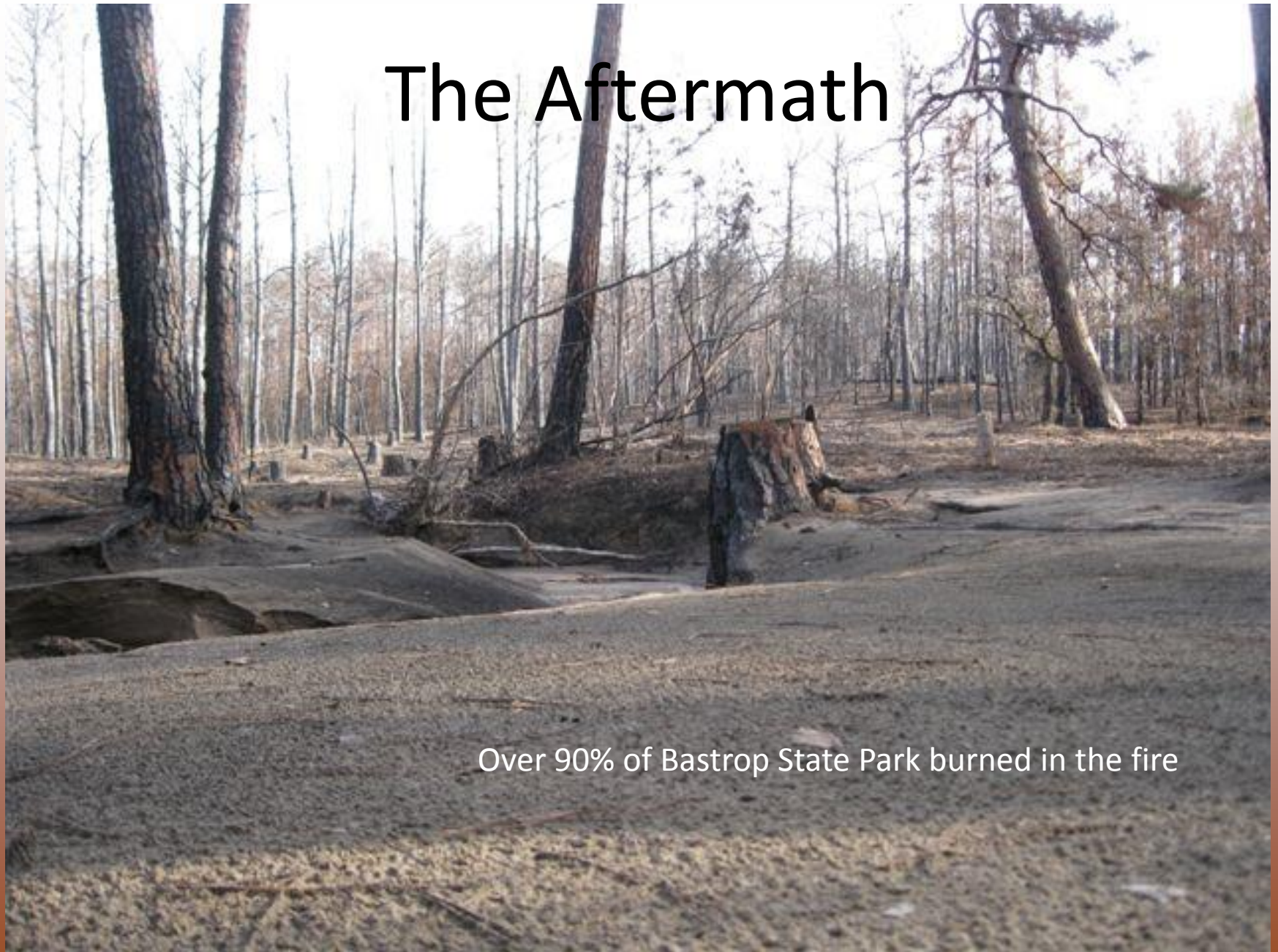
# Protecting the historic structures

- Park firefighters had time to remove pine needles from roofs and douse them with water, as well as dig fire breaks around cabin areas.





# The Aftermath



Over 90% of Bastrop State Park burned in the fire



# The Overlooks



Because of their remote locations, the terrain surrounding them, the path of the fire and the priority of the more significant historic structures, both overlooks burned.





# Materials - Wood

- Burning begins at 248° - 302°
- Bastrop fire produced air temperatures of almost 1,400° before the fire arrived
- Wood of overlook roofs were burned completely



# Materials - Mortar

- Mortar can be weakened by a fire, which can dehydrate the cement.
- Mortars typically lose strength at 572 - 752°
- Damage can range from shallow powdering (top half inch) to total disintegration.
- At BSP, the mortar was in generally good condition: superficial soiling but little visible damage
- After wildfires, mortar on structures should be regularly inspected to monitor possible weakness







# Materials - Sandstone

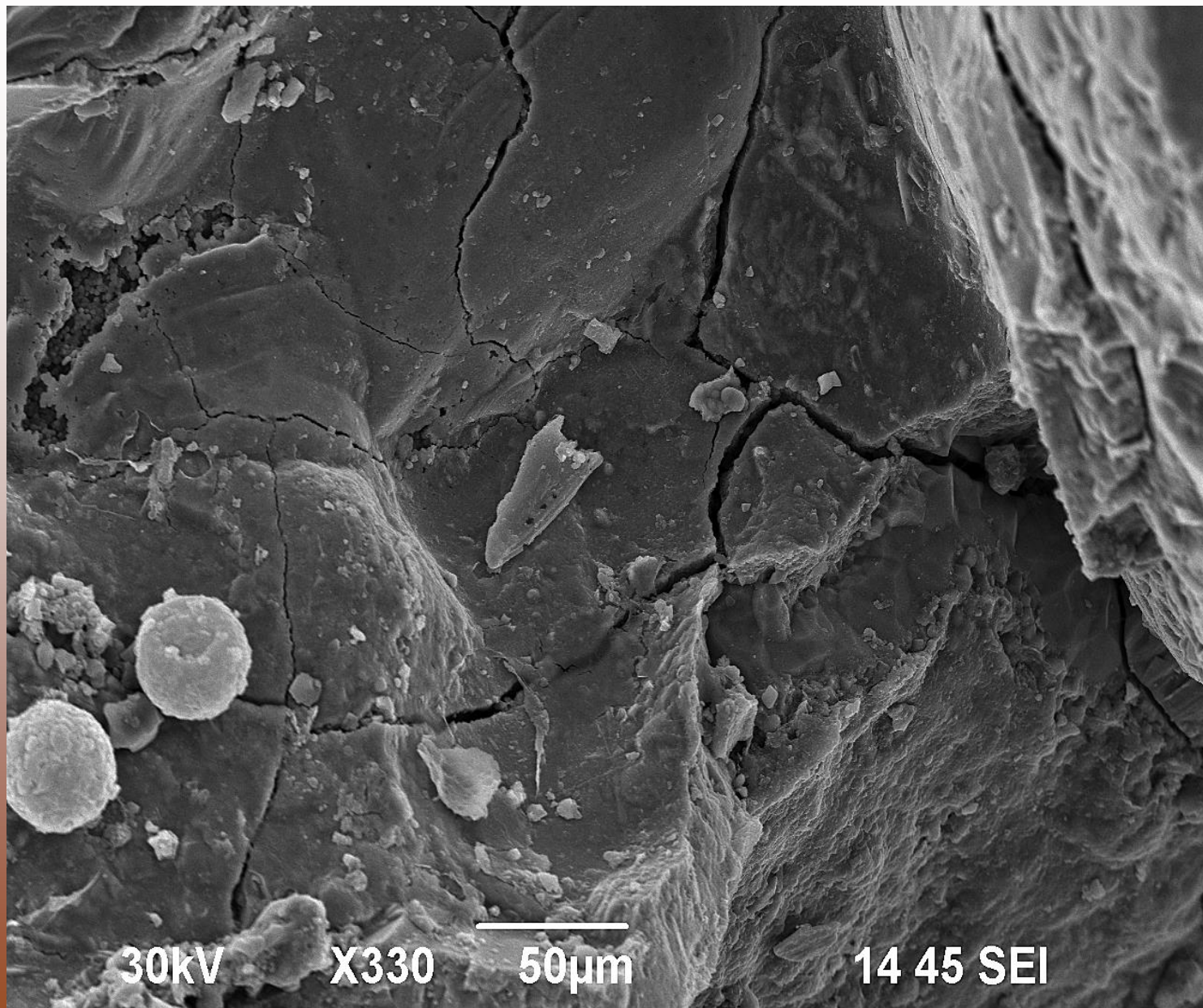
- Because of sandstone's porosity, it withstands fire damage better than stone like Granite.
- Sandstone can begin to deteriorate at  $842^{\circ}$
- Difficult to assess full damage because of issue of "shock versus fatigue" effects.





# Bastrop Sandstone Lab Testing

- Burned and unburned samples taken
- Assessed under a scanning electron microscope
- Samples showed no definitive fire decay
- Also tested for water absorption, but results were inconclusive
- Regular inspections should be made with special attention to cracking or other damage that may develop in the long term





# Fire Retardant

- Retardant was not used at BSP, but was dropped on a historic cemetery in Magnolia, Texas – the UT Team examined this cemetery to evaluate the effects of retardant on historic masonry
- There are several possible adverse effects of retardant on masonry, and should, if possible not be used on historic structures.

# Erosion

- BSP suffered severe erosion problems as a result of the extreme loss of vegetation
- Sloping terrain added to the problem
- BSP was vulnerable to severe erosion in approximately 30% of the park
- A January 2012 storm created an “emergency situation” and required immediate erosion control





# Recovery - Cleaning

- Damage such as soiling from smoke and other combustion products can impact surviving historic structures.
- Smoke contains gases and particles of soot, which, if left on some historic masonry, can cause damage.
- Cleaning historic structures should be done carefully, and may require professional conservators to assess and recommend treatment.
- In general, remove using a natural soft bristle brush, and a pH-neutral detergent

# Recovery - Erosion

- At BSP, erosion control measures included using felled trees and biodegradable water diversion systems to control run off.
- Reseeding was sped up to try to replace natural erosion controlling vegetation.





# Recovery – Fire Retardant Removal

- UT Team conducted laboratory testing of retardant removal
- Using BSP samples, retardants were applied and exposed to 100° temperatures for several days.
- Water washing was effective in removing most retardant, mild detergents removed remaining product





# Preparing for future fires

- Focusing on:
  - Substitute Materials
  - Defensible Space
  - Planning and communication



# Substitute Materials

- BSP cabins and refectory have wood shingle roofs, which are made of fire treated wood.
- Substitute materials must be carefully evaluated, balancing the need to keep the historic character with the potential protection.



# Defensible Space

- Possible to reduce the risk to park structures by adding a defensible space component to the regular and cyclical maintenance work done to park structures.
- FireWise suggestions
- Wildland Urban Interface Code
- California Code

# Defensible Space Guidelines

	"Defensible space radius"	Trees within Radius	Shrubs Within Radius	Maintenance
WUI Code	30 Feet	Yes - horizontal distance of 10 feet from structure and other tree crowns. Lowest limb must be 6 feet from ground or higher.	Yes - as long as it does not encourage fire spreading. Non-fire resistant plants	Remove dead growth, trees pruned
Firewise	30 feet (Zone 1)	None	Must be 5 feet from building	
	30 - 100 feet (Zone2)	No crown touching, trimmed	Well spaced	Remove dead growth. Metal Mesh protecting under decks/attic/soffet vents.
	100 - 200 feet (Zone 3)	Well spaced	Low volume, well spaced	
California Code	30 feet	Single trees only, lowest branch 6 - 15 feet above vegetation, depending on slope.	Welll pruned	
	30 - 100 feet (zone 2)	Stumps removed, dead trees limited to one per acre		Remove dead growth, grass kept to 4 inches and shorter, aalthough if well separated from toher fuel, can be 18 inches.



# Preparing – Park Maintenance

- Close growing trees can be removed
- Overhanging limbs can be trimmed away
- Close growing shrubs can be removed
- Trees near historic structures can be thinned
- Regular removal of dead material from roofs and surrounding structures.



# Protecting Historic Structures from Wildfires – Guidelines for Texas Parks and Wildlife

- **Assemble a Team**
- Recruit TPWD Firefighting Team members to work with cultural resource specialists on wildfire preparedness and recovery for TPWD historic structures
- Review existing emergency management plan, updating information for historic structures
- Conduct training for cultural resource specialists in firefighting strategies and for firefighting team members on cultural resource issues
- Organize discussions among Park Superintendents, Fire Incident Commanders, and cultural resource specialists regarding the use of fire retardants, methods for establishing and coordinating cultural resource priorities, and communication strategies during a wildfire
- Work with wildfire specialists to establish priority areas for carrying out prescribed burns



# Protecting Historic Structures from Wildfires – Guidelines for Texas Parks and Wildlife

- **Prepare Historic Structures**
- Conduct a survey of historic structures to document character-defining features, original and replacement materials, and existing conditions
- Obtain high quality, archival photographs of historic structures, documenting each elevation, and including close-up views of important architectural details
- Remove dead pine needles, leaves and other debris from the roofs of historic structures as a part of routine maintenance
- Provide metal mesh screens for areas below decks and patios, as well as attic, soffit and under-eave vents to prevent entry of embers
- Replace flammable roofing materials with appropriate substitute materials that are non-flammable or with materials that have been treated with fire retardant

# Protecting Historic Structures from Wildfires – Guidelines for Texas Parks and Wildlife

- **Create Defensible Space**
- Create defensible space around each historic structure, and maintain the zones through regular maintenance
- Remove dead vegetation from within 30 feet of each structure
- Trim overhanging tree limbs within 10 feet of structure
- Trim low tree branches to at least 6 feet from the ground
- Remove flammable vegetation in direct contact with structures
- Keep plantings and mulch at least 5 feet from the structures
- Trim low tree branches above shrubbery to allow for 15 foot clearance
- Trim grass to 4 inches
- Note: Benefits of the above recommendations should be weighed against the possible negative impact on the cultural landscape surrounding the historic structure.

# Protecting Historic Structures from Wildfires – Guidelines for Texas Parks and Wildlife

- **Begin Recovery Operations**
- As soon as it is safe to reenter the park, inspect historic structures, using the rapid assessment form to catalog the damage
- Document the fire damage in photographs before undertaking cleaning or removal of material
- Allow buildings to dry through natural ventilation if saturated
- If fire retardants have come in contact with historic masonry, clean as soon as possible
- Remove dead or weakened trees or tree limbs that are near historic structures
- Determine potential for erosion/flooding issues that could impact the historic resources



## TPWD Post-WildFire Historic Structure Conditions Assessment

## Inspection

Inspection date ..... time ..... ☐ AM ☐ PM      Area Inspected ☐ Exterior Only  
☐ Exterior and Interior

Inspector .....

### Property Description

Structure .....	Type of Construction	Occupied? ○ yes ○ no
Park .....	<input type="checkbox"/> Wood Frame <input type="checkbox"/> Manufactured <input type="checkbox"/> Boat <input type="checkbox"/> Steel Frame <input type="checkbox"/> Brick <input type="checkbox"/> Other <input type="checkbox"/> Concrete <input type="checkbox"/> Stone	Repairs begun? ○ yes ○ no
Number of stories above ground ..... below ground .....	Primary Occupancy	
Approx footprint area (square feet) .....	<input type="checkbox"/> Dwelling <input type="checkbox"/> School <input type="checkbox"/> Other Residential <input type="checkbox"/> Cemetery <input type="checkbox"/> Public Assembly <input type="checkbox"/> Other <input type="checkbox"/> Emergency Services <input type="checkbox"/> Commercial <input type="checkbox"/> Offices <input type="checkbox"/> Museum	
Contact Info .....		
.....		
.....		
.....		

**Property Location Data:**

Collect GPS data if possible, in decimal degrees using NAD83 datum  
( $\pm 3$  meters) use minutes:seconds

<b>Data:</b>	Location 1	Location 2	Location 3	Location 4	Location 5
Data N					
Data W					
description					

### Significance

Does this property appear historic? (older than 50 years) ☐ yes ☐ no ☐ don't know

Is there a sign or plaque? ☐ yes ☐ no ☐ don't know

Is this a CCC era structure? ☐ yes ☐ no ☐ don't know

## Designation

☐ Nat'l Hist. Landmark/District  
☐ Nat'l Register/District  
☐ State/Local  
☐ Nat'l Register Eligible  
☐ Other...

### Potential Hazards

Is it possible to enter the building or site? ☐ yes ☐ no      Is it **Safe** to enter the building or site? ☐ yes ☐ no

Interior Condition ☐ Structural Damage ☐ Mold/Mildew ☐ Falling Plaster ☐ Sediment/Soil ☐ Hazards

Exterior Condition ☐ Structural Damage ☐ Mold/Mildew ☐ Falling Plaster ☐ Sediment/Soil ☐ Hazards

Comments

**Direct Impacts:**

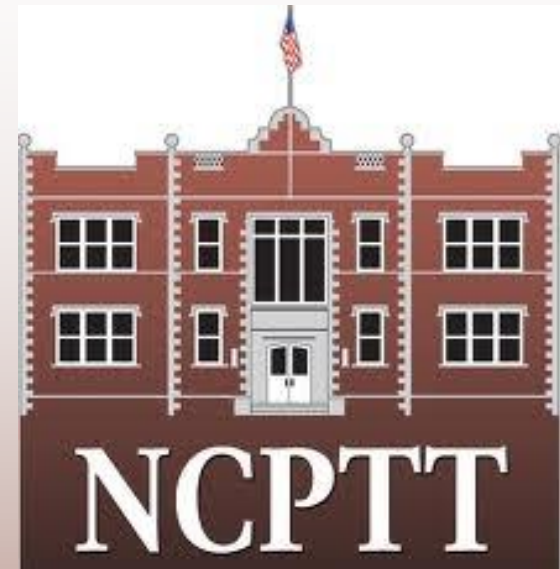
Damage to windows, doors	Porch Damage	<input type="checkbox"/> None	<input type="checkbox"/> Singed	<input type="checkbox"/> Partial burn	<input type="checkbox"/> Complete burn	<input type="checkbox"/> Gone	<input type="checkbox"/> N/A
	Siding Damage	<input type="checkbox"/> None	<input type="checkbox"/> Singed	<input type="checkbox"/> Partial burn	<input type="checkbox"/> Complete burn	<input type="checkbox"/> Gone	<input type="checkbox"/> N/A
	Corniche Damage	<input type="checkbox"/> None	<input type="checkbox"/> Singed	<input type="checkbox"/> Partial burn	<input type="checkbox"/> Complete burn	<input type="checkbox"/> Gone	<input type="checkbox"/> N/A
	Roof Damage	<input type="checkbox"/> None	<input type="checkbox"/> Singed	<input type="checkbox"/> Partial burn	<input type="checkbox"/> Complete burn	<input type="checkbox"/> Gone	<input type="checkbox"/> N/A
	Shutter Damage	<input type="checkbox"/> None	<input type="checkbox"/> Singed	<input type="checkbox"/> Partial burn	<input type="checkbox"/> Complete burn	<input type="checkbox"/> Gone	<input type="checkbox"/> N/A
	Balcony Damage	<input type="checkbox"/> None	<input type="checkbox"/> Singed	<input type="checkbox"/> Partial burn	<input type="checkbox"/> Complete burn	<input type="checkbox"/> Gone	<input type="checkbox"/> N/A
	Ceilings	<input type="checkbox"/> None	<input type="checkbox"/> Singed	<input type="checkbox"/> Partial burn	<input type="checkbox"/> Complete burn	<input type="checkbox"/> Gone	<input type="checkbox"/> N/A
	First Floor flooring	<input type="checkbox"/> None	<input type="checkbox"/> Singed	<input type="checkbox"/> Partial burn	<input type="checkbox"/> Complete burn	<input type="checkbox"/> Gone	<input type="checkbox"/> N/A
	First Floor structure	<input type="checkbox"/> None	<input type="checkbox"/> Singed	<input type="checkbox"/> Partial burn	<input type="checkbox"/> Complete burn	<input type="checkbox"/> Gone	<input type="checkbox"/> N/A
	First floor walls	<input type="checkbox"/> None	<input type="checkbox"/> Singed	<input type="checkbox"/> Partial burn	<input type="checkbox"/> Complete burn	<input type="checkbox"/> Gone	<input type="checkbox"/> N/A
Damage to upper floors	<input type="checkbox"/> None	<input type="checkbox"/> Singed	<input type="checkbox"/> Partial burn	<input type="checkbox"/> Complete burn	<input type="checkbox"/> Gone	<input type="checkbox"/> N/A	

### Comments



Originally developed for FEMA by the NPS National Center for Preservation Technology and Training in collaboration with the Heritage Emergency National Task Force.  
Adapted for Texas Parks and Wildlife.





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